

## **APPENDIX E**

**MEASURES RELATED TO PROJECT SPILL FOR FISH**

**PASSAGE, FROM THE NMFS 2000 BIOLOGICAL**

**OPINION ON FCRPS OPERATION**

**(SECTIONS 9.6.1.4.3 AND 9.6.1.4.4,**

**PAGES 9-88 TO 9-92)**

#### ***9.6.1.4.3 Current and Near-term Actions***

##### Spill Program

**Action 54:** The Corps and BPA shall implement an annual spill program, consistent with the spill volumes and TDG limits identified in Table 9.6-3, at all mainstem Snake and Columbia River FCRPS projects as part of the annual planning effort to achieve the juvenile salmon and steelhead performance standards.

The annual spill program will be based on the best available monitoring and evaluation data concerning project passage, spill, and system survival research. The Action Agencies, in consultation with the Technical Management Team and with the approval of NMFS, will conduct a preseason determination of the specific annual spill levels and dates at each project. The planning dates for the annual spill program are April 3 to June 20 and June 21 to August 31 for the spring and summer migration periods, respectively, in the Snake River, and April 10 to June 30 and July 1 to August 31 for the spring and summer migration periods, respectively, in the lower Columbia River. Initial estimates of project spill levels, and the basis for each estimate, are shown in Table 9.6-3.

The specific spill volumes listed in Table 9.6-3 must be viewed as approximate because the TDG levels measured at the monitoring site below each project, at a given spill level, can vary with such factors as river flow, forebay dissolved gas level, spill patterns, and water temperature changes. Spill levels at some projects may change as spill patterns are refined or if deflector optimization measures are implemented. There are also project-specific limitations on spill levels for reasons other than TDG, including adult passage, navigation, and research activities. These limitations are typically of short duration, but they can affect spill for fish passage to a limited degree.

Interruptions or adjustments in spill may occur due to unforeseeable power system, flood control, or other emergencies. The Action Agencies should view such emergency actions as last resorts, and they should not be used in place of the long-term investments necessary to allow full, uninterrupted implementation of the required spill levels while maintaining other project purposes, such as an adequate and reliable power system.

Discussion of emergencies with effects of exceptional magnitude or duration should include involvement of regional executives. Section 9.4.2.2 provides for the development of more specific process modifications to address these needs in the water management plans.

#### ***9.6.1.4.4 Project-by-project Spill Requirements***

Lower Granite Dam. To achieve the desired fish passage efficiencies, the 1995 FCRPS Biological Opinion set the Lower Granite spill level at 80% of total instantaneous discharge for

12 hours per day. Under most conditions, however, this level of spill could not be implemented because the gas cap was reached at spillway flows of 40 kcfs (1998 Supplemental FCRPS Biological Opinion). More recent information suggests that the gas cap will be reached at about 60 kcfs; this level is the appropriate current spill limit. Based on radio-tracking studies with adult chinook, performed at Lower Granite Dam during 1996 and 1997, a spill level of 60 kcfs does not appear to affect adult passage adversely (Bjornn 1998, Bjornn 2000). It may be necessary to reduce spill to accommodate safety concerns when juveniles are being loaded directly onto barges for transportation downstream, and the barges must be docked for extended periods. Spill operations must also consider research needs critical to the ongoing evaluation of the surface bypass prototype (e.g., project operations in 2000 have been modified to spill for 24 hours per day instead of only at night, and powerhouse operations have been modified to provide the required hydraulic conditions in the immediate forebay).

**Table 9.6-3.** Estimated spill levels and gas caps for FCRPS projects during spring (all) and summer (nontransport projects).

<b>Project<sup>1</sup></b>	<b>Estimated Spill Level<sup>2</sup></b>	<b>Hours</b>	<b>Limiting Factor</b>
Lower Granite	60 kcfs	6 p.m. - 6 a.m.	gas cap
Little Goose	45 kcfs	6 p.m. - 6 a.m.	gas cap
Lower Monumental	40 kcfs	24 hours	gas cap
Ice Harbor	100 kcfs (night) 45 kcfs (day)	24 hours	nighttime - gas cap daytime - adult passage
McNary	120-150 kcfs	6 p.m. - 6 a.m.	gas cap
John Day	85-160 kcfs/60% <sup>3</sup> (night)	6 p.m. - 6 a.m. <sup>4</sup>	gas cap/percentage
The Dalles	40% of instant flow	24 hours	tailrace flow pattern and survival concerns (ongoing studies)
Bonneville	90-150 kcfs (night) 75 kcfs (day)	24 hours	nighttime - gas cap daytime - adult fallback

<sup>1</sup> Summer spill is curtailed beginning on or about June 20 at the four transport projects (Lower Granite, Little Goose, Lower Monumental, and McNary dams) due to concerns about low inriver survival rates.

<sup>2</sup> Estimated spill levels shown in the table will increase for some projects as spillway deflector optimization measures are implemented.

<sup>3</sup> The TDG cap at John Day Dam is estimated at 85 to 160 kcfs, and the spill cap for tailrace hydraulics is 60%. At project flows up to 300 kcfs, spill discharges will be 60% of instantaneous project flow. Above 300 kcfs project flow, spill discharges will be at the gas cap (up to the hydraulic limit of the powerhouse).

<sup>4</sup> Spill at John Day Dam will be 7:00 p.m. to 6:00 a.m. (night) and 6:00 a.m. to 7:00 p.m. (day) between May 15 and July 31.

BPA has specified 11.5 kcfs as a minimum powerhouse flow for system reliability. Because this minimum depends on the status of generation at other projects, it may not be necessary at all times.

Little Goose Dam. The 1995 FCRPS Biological Opinion set the Little Goose Dam spill level at 80% of total instantaneous discharge 12 hours per day (NMFS 1998). As at Lower Granite Dam, the Action Agencies could not usually implement this level because the gas cap was reached at spillway flows of approximately 35 kcfs. More recent information suggests that the gas cap will be reached at about 45 kcfs; this level is the appropriate current limit at Little Goose Dam. Based on radio-tracking studies with adult chinook performed during 1997, a spill level of 60 kcfs did not appear to affect adult passage adversely (Peery 1998).

BPA has specified 11.5 kcfs as a minimum powerhouse flow for system reliability. Because this minimum depends on the status of generation at other projects, it may not be necessary at all times.

Lower Monumental Dam. The 1995 FCRPS Biological Opinion set the Lower Monumental Dam spill level at 81% of total instantaneous discharge for 12 hours per day (NMFS 1998). Again, this level of spill was not provided voluntarily, because the gas cap was reached at spillway flows of approximately 40 kcfs. The estimate of spill at the gas cap has not changed. Spill levels to the gas cap will now, however, be provided for 24 hours per day. Based on radio-tracking studies with adult chinook performed during 1997, a spill level of 45 kcfs did not appear to affect adult passage adversely (Peery 1998, Bjornn 2000). Because the gas cap is currently reached at approximately 40 kcfs, no reduction in spill is necessary for adult passage.

Accelerated erosion in the spillway stilling basin apron has recently been noted as a concern by the Corps. NMFS is concerned that the Corps may decide, for safety reasons, to limit fish passage spill until the noted erosion is corrected. To ensure that 24-hour fish passage spill, as described above, is not limited, the Corps and BPA will respond to the problem by initiating timely corrective measures.

BPA has specified 11.5 kcfs as a minimum powerhouse flow for system reliability. Because this minimum depends on the status of generation at other projects, it may not be necessary at all times.

Ice Harbor Dam. The 1995 FCRPS Biological Opinion prescribed spill levels at Ice Harbor Dam of 27% in the spring and 70% in the summer, each for 24 hours per day. The 27% spring objective was often reached, even though the gas cap limited voluntary spill to flows of 25 kcfs. The summer target of 70% was also reached at the lower flow levels (NMFS 1998). Due to the installation of spillway flow deflectors, more recent information suggests that the gas cap will be reached at 100 kcfs. Based on research performed during the early 1980s, adult passage would become a concern at daytime (5:00 a.m. to 8:00 p.m.) spill in excess of 45 kcfs. Recent information from radio-tracking studies performed from 1996 to 1998 suggests that spill levels

from 55 to 70 kcfs did not appear to affect adult passage adversely (Peery 1998, Bjornn 2000 ). The 45-kcfs, adult-passage daytime cap may have to be reconsidered once the final study results are available. No change is now proposed, however, and the daytime limit remains 45 kcfs.

BPA has specified 7.5 to 9.5 kcfs as minimum powerhouse flows for system reliability. Because this minimum depends on the status of generation at other projects, it may not be necessary at all times.

McNary Dam. The 1995 FCRPS Biological Opinion set the McNary Dam spill level at 50% of total instantaneous discharge for 12 hours per day (NMFS 1998). Due to limited powerhouse capacity, and because the gas cap was reached at spillway flows of 120 kcfs, these spill levels were reached under most conditions. More recent information suggests that the gas cap will be reached at about 135 kcfs.

BPA has specified a minimum powerhouse flow of 50 kcfs to maintain power transmission system stability.

John Day Dam. The 1998 FCRPS Supplemental Biological Opinion set the John Day Dam spill level at 60% of total instantaneous discharge up to the gas cap during the nighttime hours. At project flows up to 300 kcfs, spill discharges will be 60% of instantaneous project flow during 12 hours per day. Above 300 kcfs, spill discharges will be the gas cap (up to the hydraulic limit of the powerhouse). With the completion of spillway deflectors and new spill patterns, gas cap spill flow has ranged up to 170 kcfs. Spill limits of 25% minimum and 60% maximum are imposed to ensure adequate juvenile egress conditions from the spillway at low spill flows and from the juvenile bypass system during high spill flows. General physical model studies have indicated that spill percentages below 25% create poor egress conditions (eddies and slack water) in the spillway tailrace, and spill levels above 60% tend to create a large eddy in the tailrace below the powerhouse that can actually cause flow from the bypass to move upstream.

BPA has specified a minimum powerhouse flow of 50 kcfs to maintain power transmission system stability.

The Dalles Dam. The 1995 FCRPS Biological Opinion prescribed a spill level at The Dalles Dam of 64% for 24 hours (NMFS 1998). Spill survival studies NMFS conducted in 1997, 1998, and 1999 indicated that the 64% spill level can result in relatively low spillway survival compared to fish released below the project. These studies also indicated that a 30% spill level spillway survival was always as good or higher than the 64% level. Companion studies using radio-tagged fish and hydroacoustic monitoring indicated that reducing the spill percentage from 64% to 30% caused more fish to pass through the powerhouse sluiceway and turbines. Turbine survival has not been measured at this project, but it is assumed to be no better than that observed at other projects. Details of these studies and references can be found in NMFS 2000a.

Based on the available information, the ISAB recommended an evaluation of 24-hour spill levels at The Dalles in the 30% to 50% range (ISAB 2000). NMFS recommends an evaluation of 24-hour spill at the 40% level and expects to improve juvenile fish survival with this interim spill operation (see Section 9.6.1.4.5). Additionally, because reduced juvenile survival at higher spill levels may have been related to the daylight adult spill pattern, there is potential for higher than 40% nighttime spill with a juvenile passage pattern after The Dalles survival tests are concluded, and the results are evaluated. Upon completion of these tests, modified spill levels and patterns should be evaluated for adult passage and fallback.

BPA has specified a minimum powerhouse flow of 50 kcfs to maintain power transmission system stability.

Bonneville Dam. The 1998 FCRPS Supplement established a nighttime spill level at the TDG cap generally between 90 and 150 kcfs for the duration listed in the current Corps' Fish Passage Plan. The minimum spill level will be no less than 50 kcfs of the total river flow to provide good tailrace egress of juvenile migrants. Daytime spill levels are limited to 75 kcfs at Bonneville Dam due to concerns for adult salmonid fallback through the spillway. Recent evidence from adult radio-tracking studies conducted in 1996, 1997, and 1998 indicates that increases in adult fallback associated with increased daytime spill flows from 75 to 120 kcfs range are relatively small. Juvenile passage benefits from the increased spill level would likely outweigh small adult losses that may be associated with the higher spill level. Further, spillway deflector optimization improvements may result in more uniform spill gate openings, which could reduce adult fallback rates. NMFS believes this issue warrants further investigation. Planned studies are described below.

BPA has specified a minimum powerhouse flow of 30 kcfs.